MITSUBISHI HEAVY INDUSTRIES, LTD.
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TOKYO, JAPAN

December 19, 2013

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attention: Mr. Jeffrey A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-13302

Subject: MHI's Response to US-APWR DCD RAI No.1064-7302 (SRP 04.02)

Reference: 1) REQUEST FOR ADDITIONAL INFORMATION 1064-7302 dated on December 3, 2013

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "MHI's Response to US-APWR DCD RAI No.1064-7302 (SRP 04.02)".

Enclosed is the response to Question 4.2-67 contained within Reference 1.

As indicated in the enclosed materials, this document contains information that MHI considers proprietary, and therefore should be withheld from public disclosure pursuant to 10 C.F.R. §2.390 (a)(4) as trade secrets and commercial or financial information which is privileged or confidential. A non-proprietary version of the document is also being submitted with the information identified as proprietary redacted and replaced by the designation "[ ]".

This letter includes a copy of the proprietary version (Enclosure 2), a copy of the non-proprietary version (Enclosure 3), and the Affidavit of Tatsuya Hashimoto (Enclosure 1) which identifies the reasons MHI respectfully requests that all materials designated as "Proprietary" in Enclosure 2 be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4).

Please contact Mr. Joseph Tapia, General Manager of Licensing Department, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of this submittal. His contact information is provided below.

Sincerely,

T. Hashimoto for

Yoshiki Ogata,
Executive Vice President
Mitsubishi Heavy Industries, LTD.
On behalf of Mitsubishi Heavy Industries, LTD.

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NRO

Enclosures:

1. Affidavit of Tatsuya Hashimoto
2. MHI's Response to US-APWR DCD RAI No.1064-7302 (SRP 04.02) (Proprietary)
3. MHI's Response to US-APWR DCD RAI No.1064-7302 (SRP 04.02) (Non-Proprietary)

CC: J. A. Ciocco
J. Tapia

<u>Contact Information</u>
Joseph Tapia, General Manager of Licensing Department
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Enclosure 1

Docket No.52-021
MHI Ref: UAP-HF-13302

MITSUBISHI HEAVY INDUSTRIES, LTD.
AFFIDAVIT

I, Tatsuya Hashimoto, state as follows:

1. I am Manager, US-APWR Project of Global Nuclear Project Department, of Mitsubishi Heavy Industries, LTD. (MHI), and have been delegated the function of reviewing MITSUBISHI HEAVY INDUSTRIES, LTD's ("MHI") US-APWR documentation to determine whether it contains information that should be withheld from disclosure pursuant to 10 C.F.R. § 2.390 (a)(4) as trade secrets and commercial or financial information which is privileged or confidential.

2. In accordance with my responsibilities, I have reviewed the enclosed document entitled "MHI's Response to US-APWR DCD RAI No.1064-7302 (SRP 04.02)", and have determined that portions of the document contain proprietary information that should be withheld from public disclosure. Those pages containing proprietary information are identified with the label "Proprietary" on the top of the page and the proprietary information has been bracketed with an open and closed bracket as shown here "[ ]". The first page of the document indicates that all information identified as "Proprietary" should be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4).

3. The information in the report identified as proprietary by MHI has in the past been, and will continue to be, held in confidence by MHI and its disclosure outside the company is limited to regulatory bodies, customers and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and is always subject to suitable measures to protect it from unauthorized use or disclosure.

4. The basis for holding the referenced information confidential is that it describes the unique test method, conditions, parameters and result data for the US-APWR fuel development.

5. The referenced information is being furnished to the Nuclear Regulatory Commission ("NRC") in confidence and solely for the purpose of information to the NRC staff.

6. The referenced information is not available in public sources and could not be gathered readily from other publicly available information. Other than through the provisions in paragraph 3 above, MHI knows of no way the information could be lawfully acquired by organizations or individuals outside of MHI.

7. Public disclosure of the referenced information would assist competitors of MHI in their design of new nuclear power plants without incurring the costs or risks associated with the design of the subject systems. Therefore, disclosure of the information contained in the referenced document would have the following negative impacts on the competitive position of MHI in the U.S. nuclear plant market:

   A. Loss of competitive advantage due to the costs associated with development of the design of US-APWR fuel systems and components. Providing public access to such information permits competitors to duplicate or mimic the design of new fuel system and

components without incurring the associated costs.

B. Loss of competitive advantage of the US-APWR created by benefits of enhanced development costs associated with the design of US-APWR fuel systems and components.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information and belief.

Executed on this 19th day of December, 2013.

T. Hashimoto

Tatsuya Hashimoto
Manager- US-APWR Project
Of Global Nuclear Project Department
Mitsubishi Heavy Industries, LTD

Enclosure 3

UAP-HF-13302
Docket No. 52-021

MHI's Response to US-APWR DCD RAI No.1064-7302 (SRP 04.02)

December 2013
(Non-Proprietary)

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

12/19/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO. 1064-7302

SRP SECTION: 4 – REACTOR

APPLICATION SECTION: 04.02 – FUEL SYSTEM DESIGN

DATE OF RAI ISSUE: 12/3/2013

QUESTION NO. : 04.02-67

Technical Report MUAP-13020-P (Rev. 0) refers to past MHI conventional 12-ft fuel assembly testing with axial flow conditions. However, no specific document reference was listed. Please provide the document(s) which describe these tests and present the results.

ANSWER:

Although Technical Report MUAP-13020-P refers to the past MHI conventional 12-ft fuel assembly testing with axial flow conditions, the US-APWR AFD testing is independent from the 12-ft fuel AFD assembly testing and by itself provides a justification for crediting the effect of flow damping for US-APWR fuel assemblies. Therefore, the descriptions of 12-ft fuel assembly AFD testing in MUAP-13020-P will be deleted.

Impact on DCD

There is no impact on DCD.

Impact on R-COLA

There is no impact on R-COLA.

Impact on PRA

There is no impact on PRA.

Impact on Topical/Technical Report

Technical Report MUAP-13020 will be revised as shown in Attachment-1 to this response.

Abstract

The US-APWR plant is designed to withstand seismic/LOCA loading as part of safety analysis. Structural damping of fuel assembly in reactor coolant plays an important role to accurately characterize seismic/LOCA fuel assembly response in the analysis. The damping ratios of the fuel assembly vary depending on the coolant operating conditions (e.g., still water, flowing water). In the past, damping response evaluations under axial flow conditions have been conducted and the results were published by several facilities.

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This report addresses the axial flow damping (AFD) response for a representative US-APWR mock-up fuel assembly under still water and axial flow conditions, with variable displacements, coolant flow rates, and temperature conditions. ~~This testing is based on the past MHI experience with conventional 12 ft fuel assembly vibration characteristic testing under axial flow conditions.~~

Tests were performed at room temperature in the still water testing, and at three different temperature conditions with axial flow. Various flow rates, dependent on the thermal design flow (TDF), were tested at each temperature. Multiple fuel assembly initial displacements were applied at each condition. Based on the test, the amplitude dependent damping ratio and frequency values were obtained.

The AFD test results show that:

These results will be used to determine input to the US-APWR fuel seismic response analysis to account for the AFD effect (Reference 1) and the results will be shown in the next revision of MUAP-08007 "Evaluation Results of US-APWR Fuel System Structural Response to Seismic and LOCA loads" (Reference 2).

assembly is generated with [ ] equipment.

An overview of the test procedure is shown in Figure 3.2-2. The AFD testing is run for each temperature test condition seen in Table 3.2-1. First, the water temperature is set in the test loop to the desired temperature, and the measurement systems are confirmed to be properly working. The [ ] equipment is checked and background measurements of LVDTs are taken in the still water condition. Then, the pump flow rate is set and measured. The initial displacement is added to the fuel assembly by the [ ] equipment under constant flow conditions and released. Finally, the fuel assembly is released and the displacement time history of the middle grid is measured. These measurements are taken for each initial displacement condition shown in Table 3.2-1. After each initial displacement condition is run for a given temperature setting, the flow rate is changed. After the tests under all the combinations of initial displacements and flow rates are performed, the temperature condition is changed until all tests are complete. Each test condition is repeated three times, to ensure repeatability.

In addition, pluck tests are conducted to study the frequency and damping characteristics under still water condition and axial flow conditions.

3.3. AFD Test Conditions

The test matrix is shown in Table 3.2-1. The test parameters are initial displacement of the fuel assembly, temperature, and flow rate.

The gaps between the mock-up fuel assembly and the wall of the test section are shown in Table 3.3-1. A [ ] is set as the maximum initial displacement distance. In the orthogonal direction, a [ ] is set to avoid contact between the mock-up fuel assembly and the test wall during vibration.

3.3.1. Initial Displacement Conditions

The initial displacement parameter evaluates the damping and frequency dependencies on amplitude. Testing took place at the test section with initial displacements of [ ], as shown in Table 3.2-1. These four initial displacement points can be used to interpolate the amplitude impact on frequency and damping of the fuel assembly.

3.3.2. Temperature Conditions

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Testing is performed at [ ], as shown in Table 3.2-1.

Both water density and kinematic viscosity are dependent on water temperature and therefore affect the vibration response. ~~However, the MHI conventional 12 ft fuel assembly testing with axial flow conditions showed that the temperature effect of AFD appears to be very small up to the reactor operating condition from the maximum test temperature (Reference 5). Therefore, MHI expects that the additional testing will confirm the temperature dependency of the AFD effect on the US-APWR fuel assembly.~~ Damping ratios are interpolated from the test condition to reactor operating condition, if necessary.